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GEOLOGICAL REPORT

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JACK COUNTY, TEXAS

Prepared and Compiled by

W. M. GRANT

OIL GEOLOGIST

Published by
JACKSBORO CHAMBER of COMMERCE
OIL DEPARTMENT

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PUBLISHER'S NOTE.

Jack County, Texas, is geographically located in the center of the Pennsylvanian formation of North Texas, as shown on the U. S. Government geological map. The U. S. Government some twenty years ago made a geological report on Jack County, and at that time reported that Jack County contained the most favorable oil structure of any County of North Texas. About eight years ago, one of the large oil companies of Bakersfield, California, sent a geologist to Jack County to check up the Government geologist. His report was substantially the same as that of the Government.

The north central part of Jack County has produced oil from shallow depths and in small quantities for several years. A small refinery was built and refined the oil from these wells for some time. The oil as it came from the wells was of an exceedingly high grade, and sold at the well from \$7.00 to \$10.00 per barrel. The producing area became involved in litigation and has been closed down for the past five years, and it was only when oil at great depth and in large volumes was discovered in adjoining counties that the oil industry in Jack County was revived. The following wells are now in process of sirking:

Mackenzie, J. W. Knox No. 1, located on the famous Knox Terrace near the center of the Patrick Osborn Survey $2\frac{3}{4}$ miles east of Jacksboro; drilling at 1010 feet.

Bennett Oil Corporation, J. W.

Knox No. 1, also located on the Knox Terrace near the center of the Elisha T. Robinson Survey, 4½ miles southeast of Jacksboro; shut down awaiting the arrival of tools.

Cosden Oil & Gas Co., Victor Stewart No. 1, northwest corner Texas Immigration & Land Co. Survey No. 2783, 15 miles northwest of Jacksboro; drilling around 2650 feet.

Cosden Oil & Gas Co., Cherryhomes No. 1, northeast corner of Irwin Survey, fourteen miles northeast of Jacksboro; casing set at 3640 feet and drilling around 3840 feet in black shale.

Southern States Oil Co., Cherryhomes No. 1, center of G. & B. N. Survey No. 4, 8 miles east of Jacksboro; drilling around 1350 feet.

Hutson & Jackson, Lindsey Estate No. 1, southeast corner of Isaac N. Wright 640-acre Survey, 8½ miles

north of Jacksboro; shut down at 1010 feet.

Frontier Oil & Gas Co., David Lindsey No. 1, west central part of Isaac N. Wright 1420-acre Survey, 9 miles north of Jacksboro; derrick completed; awaiting arrival of tools.

S. B. Felt, Dr. J. Younger No. 1, south of Wood County School Land Survey, 14 miles north of Jacksboro; drilling around 1300 feet.

Great Plains Oil & Gas Co., Green Bros. No. 1, southwest corner T. E. & L. Co. Survey No. 2730, 12 miles south of Jacksboro; 1970 feet. closed down pending readjustment of drilling contract.

Sapulpa Refining Co. and Roxana Petroleum Co. of Oklahoma, Mrs. Elinor Oliver No. 1, center of Thos. Kane Survey, 4½ miles southwest of Jacksboro; 15½ inch casing set and drilling around 950 feet.

At this writing, September 15th, 1919, the Sin-

clair well, known locally as the Holt well, located in Palo Pinto County four miles south of the Jack County line, is producing some fifty barrels of oil and about two million feet of gas every twenty-four hours. This well is down 4160 feet and they have penetrated the black lime only about thirty feet. They are today drilling this well in and will probably shoot it, at which time it is believed it will come in for a very large flow. The bringing in of this well tends to prove up the southern part of Jack County.

The Cosden Oil & Gas Co., drilling what is locally known as the Cherryhomes No. 1, fourteen miles northeast of Jacksboro, reached the grey lime at a depth of 3580 feet. After penetrating this lime for a distance of ninety feet, they encountered the black shale, and have drilled into that some 170 feet, reaching their present depth of 3840 feet. According to the geologists, this black shale overlies the black limestone, or the point at which oil is to be expected in paying quantities. Therefore it is believed that the black lime, or the oil-bearing stratum, will be reached within the next week or ten days, providing no drilling troubles are experienced.

In four of the adjoining Counties to Jack County, production is now being obtained, and to date, only one well has been sunk in Jack County to a depth where production should be expected. That is the Cosden well, which has reached a depth of 3840 feet.

While all the large oil companies of Texas have considerable holdings in Jack County, there still remains quite a lot of available acreage for leasing and development, and this is rapidly changing hands.

To produce oil is of course one important mat-

ter to the producer, but to sell it is the MOST important, and to do that requires transportation facilities. In this connection Jack County is most fortunate, in fact, more so than most of the oil producing counties of North Texas, for Jack County has three main pipe lines traversing it. The Prairie Oil Co. has two pipe lines running from Ranger to refineries in Oklahoma, and the Sinclair Oil Co. has one main line running almost through the center of Jack County up into Oklahoma, with connections from there to Chicago. As soon as the wells in Jack County are brought in, they will immediately be connected with one or the other of these three lines and their production rapidly disposed of.

GENERAL GEOLOGY.

By W. M. Grant, Geologist.

The rocks appearing at the surface throughout the major portion of Jack County are of Pennsylvanian age or Coal Measures. In Texas, the Pennsylvanian formation is divided into three major divisions, these being, from the bottom upward, the Strawn, the Canyon, and the Cisco. In the southeastern corner of Jack County, the Strawn formation is present, and overlapping this, in an area forming a triangle about six miles on the side in the extreme southeastern corner of the County, lies the Trinity sand of Cretaceous age. The Canyon formation crosses Jack County in a northeasterly direction, forming a belt some fifteen miles wide. The northwest one-third of the County is occupied by the Cisco formation. The

Pennsylvania series in Jack County, as in all the neighboring counties, has in general a monoclinical structure dipping to the northwest at an average rate of 60 to 70 feet per mile. Underlying the Pennsylvanian formation is the Mississippian, or as it is locally termed, the Bend series, the chief members of which are the Smithwick shale and the Bend or Marble Falls limestone.

In Stephens, Eastland and Comanche Counties, the productive horizon is the Bend limestone, while in the Burkburnett Field the productive horizon is near the top of the Cisco or the bottom of the Permian formations. Inasmuch as the upper members of the Cisco are not present in Jack County, it will be impossible to get the horizon of Burkburnett Field in this County, and it follows that the County must look to the Bend formation as the most likely source of its oil.

Throughout North Central Texas, in those regions where sufficient drilling has been done to enable accurate data to be compiled, it has been found that the Pennsylvanian formations lie unconformably on the Mississippian, in general the Pennsylvanian having a dip to the northwestward of approximately 40 feet per mile in excess of that of the Mississippian.

In order that oil may accumulate in a given area in paying quantities, it is necessary that there shall exist a reservoir of sufficient size and of such a shape that the oil may accumulate therein without chance of escape. Since oil is lighter than water, it is always found that such accumulation takes place in a porous stratum which is capped by an impervious stratum folded into the shape of a dome, an anticline or a flat terrace. A structure for the accumulation of oil has nearly always

a point or a line from which the overlapping impervious stratum dips downward in all directions.

It is the object of geologists to locate such structures. Inasmuch as the Pennsylvania formations are not conformable with the Bend, that is to say, since the strata of both are not parallel to each other, it first appeared in the early stages of the Central Texas fields that the structural requirements of a reservoir for oil as mentioned above were not fulfilled in this field; but subsequent work developed that these requirements were fulfilled in the Bend. Where an anticline was shown to exist in the Bend by drilling, it was found that the Pennsylvanian formation at the surface showed a plunging anticline or nose which of itself would not have been a proper structure, but which served as an index to what existed in the underlying Bend formation. Since these

observations were made, and since the relation between the Pennsylvanian and Mississippian formations has been better understood, such structures as noses, plunging anticlines, and terraces have been eagerly sought by geologists because it is recognized that in most instances these are indices of far more perfect structures in the underlying Bend formation.

Where the dip of the Pennsylvanian formation to the westward exceeds that of the Mississippian by 60 feet per mile, it can be readily understood that where the Pennsylvanian is found to be level the underlying Mississippian rocks must have a reverse dip to the eastward of 60 feet to the mile. Similarly, when a plunging anticline or nose is observed which locally reduces the dip to less than 60 feet per mile, the reverse dip of the underlying Bend must be the difference between

60 feet per mile and the observed dip of the Pennsylvanian.

In addition to local structures that exist in both the Pennsylvanian and Bend formations, drilling has disclosed the fact that there exist in the Bend formation itself several major structures, these being areas of elevation and depression of a considerable extent. There exists one of these major uplifts under a large part of Stephens and Eastland Counties, and this major uplift is bounded on the northeast by a great depression or geo-syncline extending through Palo Pinto and Young Counties. The probability of heavy production in Jack County would be greatly influenced by whether or not there existed another major uplift under Jack County, or whether the great depression existing in Palo Pinto and Young Counties extended eastward far enough to include Jack County. Only drilling

could disclose this, but fortunately one well,—the Cherryhomes No. 1 of the Cosden Oil and Gas Co. near Cundiff, in Jack County,—has reached the Smithwick shale at a depth of 3240 feet. This formation is accurately identified by fossils observed in pieces of rock removed from the well. In no well in the State has the Smithwick shale been found more than 600 feet thick which would lead to the belief that the Bend limestone would be struck at approximately 3800 feet. From 100 to 150 feet above the Bend limestone there is often found a limestone 10-30 feet thick known as the "floating lime." Such a limestone has just been drilled through at the moment of writing which bears out the belief that the Bend limestone will be struck at a depth of approximately 3800-3900 feet. The depth at which this lime was struck indicates a certain rise of 1,500 feet in the lime

between the south line of Jack County and the Cherryhomes well. Until further drilling is completed, it will be impossible to define the shape or extent of this major uplift.

LOCAL STRUCTURES:

Realizing that a study of local structures, whether they be plunging anticlines or terraces, has been of the greatest assistance in the location of productive wells in Stephens and Eastland Counties, it becomes of interest to know whether or not such local structures exist in Jack County, and if so, their position, shape and extent.

One of the most striking and favorable looking structures in Jack County is a great terrace located on the ranch of J. W. Knox and therefore known as the Knox Terrace. This structure consists of a broad terrace some four miles long and one mile wide, which is closed on

the north and east by a plunging anticline, and which on the southwest is closed by a steep plunging syncline. Northwest of this terrace the Pennsylvania rocks have an average dip of 70 feet to the mile. Near the ends of the terrace the dip flattens out to 15 feet to the mile, while in the center of the terrace careful leveling between two water wells drilled $\frac{3}{4}$ of a mile apart show a reverse dip to the eastward of six inches in $\frac{3}{4}$ of a mile. Should the relation between the Pennsylvanian and Bend formations that exists in other parts of the State, continue to exist in this region,—and there is no reason to doubt that it does,—it follows that this great terrace is an indication of a marked reverse dip in the Bend formation underneath it, and if so, would indicate the existence of a dome in the Bend limestone covering several thousand acres. This

structure is now being tested out by D. McKenzie's Knox No. 1 Well.

On the east of this terrace and connected with it at the point of least dip, there exists a large plunging anticline or nose having a dip to the northeast, northwest and west of 20 feet to the mile. Because of the connection and close proximity of this great nose to the Knox terrace, it is probable that these two structures are connected and become one at the depth of the Bend limestone. The eastern end of this structure is being tested by the Bennett Oil Corporation.

Six miles southeast of the Knox Terrace, on an axis starting one mile west of Vineyard on the railroad and running north 30 deg. west, there exists a large gentle nose some three miles long and three miles wide, the average dip of which is 40 feet to the mile. This is bounded on the southwest by a plunging syn-

cline, the axis of which closely follows the Rock Island Railroad as far west as a point one mile southeast of Stewarton station. Southwest of this plunging syncline about a mile and a half, there exists a second syncline, the two being separated by a nose a mile long and one-half mile wide, the average dip on the crest of the nose being about 25 feet per mile. Northwest of these three structures about $3\frac{1}{2}$ miles, at the intersection of the G. T. & W. and Rock Island Railroads, there exists a narrow plunging syncline, this being the structure which terminates the Knox Terrace at its southwest end.

Nine miles north of Jacksboro, at Avis, there exist two pronounced adjoining structures, one being a dome having a reverse dip of some twenty feet, and the other being flat top plunging anticline. These two structures are separated by a

marked plunging syncline which starts due east of the northeastern structure or dome and swings about the center of the northeastern nose with a radius of one mile until the direction of the axis of the plunging syncline is northwest. The total area of the northeastern structure is approximately 2500 acres, of which 1000 acres are included in closed structure contours. The area of the southwestern nose is probably 2500 acres.

Just southeast of this structure exists an area of some 200 acres upon which many shallow wells 90 to 120 feet deep have been drilled in the past and from which oil has been taken over a period of twenty-five years. The oil taken from this area is of the highest quality, but seems confined to a very thin sand and the wells themselves have at no time had more than a few barrels per day production. It is commonly thought

that the source of this oil is the Bend limestone or some lower member of the Pennsylvania rocks, and that this oil has risen along a joint crack and has accumulated in its present position. Throughout Jack County there exist numerous places where shallow wells have produced small quantities of oil, and it is possible that these small accumulations of oil represent seepages from larger horizons below.

Northeast of Jacksboro five miles, on the River Road, there exists a gentle plunging anticline bounded on the southwest by a small syncline. This anticline is probably a northwest extension of that pronounced nose which closes the north end of the Knox Terrace.

Northwest of Jacksboro there exists a strip of country running northeast-southwest for ten miles and being ten or twelve miles wide, which has a monoclinial dip to

the northwest of 45 to 50 feet per mile.

Southeast of Jacksboro there exists a strip of country about three miles wide and ten miles long, running northeast-southwest and extending to the Knox Terrace, and which has an average dip to the northwest of 70 feet per mile.

In the Cundiff District, at the location of the Cherryhomes No. 1 well, the average rate of dip is 60 feet per mile to the northwest. Southwest of Cundiff, near the Hamilton Farm, there exists a pronounced nose one and one-half miles long and one-half mile wide, the average rate of dip on the crest of the nose being 35 feet to the mile. This nose is bounded on the south for a distance of three miles by a plunging syncline, the axis of which closely coincides with the course of the Trinity River. Just west of this nose the Empire Oil & Gas Co. drilled a

well approximately 3400 feet deep, but due to starting the hole too small, were forced to abandon it above the point where production might have been expected. Three miles southeast of Cundiff, near the Charles Connor Farm, there exists a small nose of about 200 acres in extent.

Five miles southwest of Jacksboro, on the Barton Chapel Road, there exists a nose two miles long and one mile wide, the north end of this being elevated to form a small dome. This is the site of the well being drilled by the Sapulpa Oil & Refining Co. The axis of this nose differs materially from most of those in this country since it is slightly east of north. The nose is bounded on the east by a syncline, the axis of which strikes north 25 deg. east. Away from this nose, the average rate of dip of the surrounding country is 60 feet per mile to the north-

west. Southwest of the Oliver location, some three miles distant, there exists a small nose which covers about three hundred acres, bounded on the northeast by a pronounced syncline.

Several miles to the southward there exists an area extending from a point near Perrin to west of Finis, which exhibits a number of structures and gives evidence of considerable disturbance in the past. In this area the Caddo limestone makes an escarpment, affording a very good structure control.

At Barton Chapel there exists an area of perhaps 1500 acres which would normally be considered as a broad flat-top nose, being almost level on top were it not for the fact that some eight faults, none of them having a throw of over thirty feet have split this nose into three major sections, none of which has a dip of over 15 feet per mile. This struct-

ure is bounded on the northeast by a plunging syncline, the axis of which starts four miles northwest of Perrin on the West Jacksboro Road at the Charles Hensley Farm, running thence due west until the Barton Chapel structure is reached, where it turns northwest to the M. M. Rogers Farm. This abnormally long syncline has caused a nose some four miles long to exist to the north of and parallel to it. The axis of this nose, striking as it does almost due west, is in marked contrast to the axis of the Sapulpa anticline three miles northward, which strikes east of north.

Southwest of the Barton Chapel structure there exists a very broad, gentle syncline, whose axis strikes north 20 deg. west. Some five miles west of Barton Chapel and due west of the above mentioned syncline, another nose one mile wide and two miles long has an axis striking

northwest. Southwest of this comes another gentle syncline, and southwest of that, at the town of Finis, exists another broad and extensive nose, the dip of the crest of which is about 30 feet per mile.

In general, there exist four good structures, each of considerable magnitude and separated by synclines, in a belt extending from a point five miles west of Perrin to Finis. In the area immediately northwest of Perrin, there exists a very broad gentle nose, the axis of which strikes north 15 deg. west, and the dip of which approximates 35 feet per mile. No synclines bound this nose. One and one-half miles east of Perrin exists the overlap of the Cretaceous Trinity sand upon the Pennsylvanian formation. The line marking the westerly-most extent of the Trinity sand runs northeast from this point to a point one-half mile south of Joplin, thence in a

more northeasterly direction across the Henderson County School lands into Wise County at a point three miles south of the intersection of the Wise County line with the Rock Island railroad.

The northwest one-third of Jack County offers very few structures of any magnitude. Extending southwestward from a point two miles northwest of the Avis structure is the outcrop of the Cisco Conglomerate, which forms a pronounced escarpment. This escarpment discloses the presence of several minor folds, none of which are sufficiently pronounced to warrant attention.

Starting at Bryson station and running due north to Jermyn, there exists a slight but fairly uniform folding of the structure contours, indicating a very long, narrow, slightly plunging anticline. Northeast of Bryson three miles and east of the above mentioned anticline, a

noticeable structural depression starts and runs north some two miles, where it gradually plays out. West of the above mentioned anticline, and passing the Young County line, there exists a slightly pitching syncline running due north.

In Clay and Archer Counties, just across the Jack County line, there exist two pronounced domes of several thousand acres extent. Parts of both of these domes overlap into Jack County, but the area of these structures included in the County is very small.

From the above description, two main conclusions can be drawn—

(1) As regards the major structure in the Bend limestone, the evidence of the Cosden Oil & Gas Company's Cherryhomes No. 1 well points toward a general uplift of the Bend under Jack County. This is the first and most necessary condition for heavy production to be

obtained in this County.

(2) There exist within the County many local structures, such as the Knox Terrace, giving promise of favorable conditions for local accumulation of oil. These local structures are fully equal in all respects to those which have been drilled and found productive in Stephens and Eastland Counties, and warrant the conclusion that many parts of Jack County fully justify the expenditure of drilling to the Bend limestone for the purpose of testing this area.

W. M. GRANT.

GEOLOGY AND LEASING IS THE BASIS OF THE OIL INDUSTRY.

As the prospectors and mining engineers are the pioneers of the mining industry, so the geologists are the combined prospectors and engineers of the oil industry. With one or two exceptions, all the larger companies and independent operators keep a corps of geologists in the field continuously searching for likely oil structures. As soon as a structure is discovered, it is mapped by the geological field force, a report is made to the company, and a "scout" or representative of the Land Department of the company is then sent out to lease the land covering the discovered structure. In this way, practically all the structures in the West Texas field have been located and leased, and available statistics show that to date, in the oil fields of North and West Texas, every structure which has been located by the geologists and drilled to a depth where production could be expected, has produced oil or gas.

Under the leasing system which prevails in all of the oil States, a lease on the oil and gas rights is granted by the land-owner for a period of five years, or so long as oil or gas is produced in paying quantities, which virtually makes the lease perpetual if oil and gas is discovered. In addition to the initial payment or bonus, the lease usually provides for a nominal yearly rental of \$1.00 per acre until a well

is commenced on the leased land, at which time the rental ceases. The lease also provides for a royalty of one-eighth of all the oil and gas produced, which is payable to the land-owner.

As drilling operations commence and production is obtained, the leases advance greatly in value, and in many instances in the North and West Texas fields, leases that were granted without any bonus or cash payment two years ago, have become enormously valuable, in one instance a 200 acre lease selling for four million dollars cash, and there being many other instances on record of leases selling on a basis of from five to ten thousand dollars per acre. Many investors and speculators throughout the country who are not in any way connected with or conversant with the oil industry other than having bought some of these leases as a speculation, have made a great deal of money by purchasing leases which later proved tremendously valuable by reason of the drilling of wells and the discovery of oil on adjoining or neighboring leases. In fact, as soon as a location for a well is made by a company or an independent operator, the other companies and operators endeavor to purchase a lease or leases as close as possible to the drilling location; then if the well proves to be a producer, they commence drilling operations on their own leases, and in this way the field or the oil pool is rapidly developed. Thus, where a company or independent operator is spending from \$50,-

000.00 to \$100,000.00 to develop a structure, it appears to be good business for others to purchase neighboring leases on the structure, or as close as possible to the drilling well, and if oil to the amount of a thousand barrels per day is found in the well, the leases on the adjoining land for several miles distant usually advance in price from hundreds to thousands of dollars per acre, depending upon the proximity of the leases to the producing well.

The Chamber of Commerce gives the above information merely to show how the oil industry originates and is conducted in the Texas oil fields.

Through the courtesy of the Cosden Oil & Gas Company, we publish below the log of the deepest well in Jack County, their Cherryhomes No. 1:

Lime	0	Slate	1065
Slate	12	Sand	1105
Sand	20	Slate	1115
Slate	60	Sand	1185
Sand	80	Water Slate	1195
Slate	95	Lime	1480
Sand	105	Water Slate	1485
Slate	175	Lime	1550
Lime	280	Slate	1750
Red Rock	290	Lime	2050
Slate	300	Sand	2055
Lime	315	Slate	2115
Slate	322	Sand	2350
Sand	412	Water Slate	2380
Slate	445	Sand	2480
Lime	545	Slate	2500
Slate	570	Red Rock	2550
Red Rock	650	Lime	2568
Lime	670	Sand	2570
Sand	675	Slate	2660
Slate	690	Sand	2680
Sand	715	Water Slate (black)	2720
Slate	750	Sand	3185
Sand	820	Water Slate	3215
Slate	840	Sand	3275
Sand	910	Black Shale	3300
Slate	915	Sand	3535
Lime	980	Slate (black)	3550
Slate	985	Gray lime	3580
Sand	1040	Slate	3670

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